HK 35: Elektromagnetische und Hadronische Sonden

Zeit: Donnerstag 16:30–19:00 Raum: 1C

Gruppenbericht HK 35.1 Do 16:30 1C

Double-Pion Production in Nucleon Collisions on the Nucleon and on Nuclei - the ABC Effect and its Possible Origin in a Dibaryonic Resonance* — •Mikhail Bashkanov, Heinz Clement, Evgueny Doroshkevich, Olena Khakimova, Florian Kren, Annette Pricking, Tatiana Skorodko, and Gerhard J. Wagner for the CELSIUS-WASA-Collaboration — Physikalisches Institut der Universität Tübingen

The ABC effect – an intriguing low-mass enhancement in the $\pi\pi$ invariant mass spectrum – is known from inclusive measurements of two-pion production in nuclear fusion reactions. First exclusive measurements carried out at CELSIUS-WASA for the fusion reactions leading to d or ^{3}He reveal this effect to be a σ channel phenomenon associated with the formation of a $\Delta\Delta$ system in the intermediate state and combined with a resonance-like behavior in the total cross section. Together with the observation that the differential distributions do not change in shape over the resonance region the features fulfill the criteria of an isoscalar s-channel resonance in pn and $NN\pi\pi$ systems, if the two emitted nucleons are bound. It obviously is robust enough to survive in nuclei as a dibaryonic resonance configuration. In this context also the phenomenon of $N\Delta$ resonances is reexamined.

* supported by BMBF, COSY-FFE, DFG(Eur. Graduate School)

HK 35.2 Do 17:00 1C

Neutrinoinduzierte kohärente Pionenproduktion an C12 — •Stefan Winkelmann, Stefan Bender, Tina Leitner und Ulrich Mosel — Institut für Theoretische Physik, Universität Gießen

Wir untersuchen, wie bei der neutrinoinduzierten kohärenten Produktion von Pionen über die bestehenden theoretischen Ansätze und Näherungen hinausgegangen werden kann, um das theoretische Verständnis dieser Reaktion zu verbessern. Speziell wird untersucht, wie sich die explizite Berücksichtigung der im Kern gebundenen Nukleonen auf die differentiellen Wirkungsquerschnitte auswirkt. Die Nukleonenzustände werden dabei im Rahmen einer Mean-Field-Rechnung beschrieben. Vor dem Hintergrund aktueller und geplanter Experimente zur Neutrinophysik ist ein besseres Verständnis dieser Reaktion notwendig, da Oszillationsexperimente wie K2K und MiniBooNE auf eine möglichst genaue Kenntnis der Reaktionen der Neutrinos mit dem jeweiligen Detektormaterial angewiesen sind.

HK 35.3 Do 17:15 1C

Quasifree Λ, Σ^0, and Σ^- electroproduction from ^{1,2}H, ^{3,4}He and carbon — •Frank Dohrmann — FZ Dresden-Rossendorf, Institut f. Strahlenphysik, Dresden, Germany

A comprehensive study of kaon electroproduction on light nuclei has been conducted in Hall C of the Thomas Jefferson National Accelerator Facility by the E91-016 collaboration. Data were obtained using electron beams of 3.245 GeV impinging on special high density cryogenic targets of ^{1,2}H, ^{3,4}He, as well as on a solid carbon target. Specifically, the measurements on ^{3,4}He are the first performed. Previously, the observation of hypernuclear bound states was discussed [1]. This presentation will give the final results of the data analysis, focussing on the quasifree production cross sections for the Λ and Σ hyperons for the various target nuclei [2]. We also derive effective proton numbers from our data and compare these numbers with model calculations. Deviations may indicate possible in-medium modifications of the kaon electroproduction mechanism.

[1] F. Dohrmann et al [E91016 collab.] Phys. Rev. Lett. **93** (2004) 242501

[2] F. Dohrmann et al [E91016 collab.] Phys. Rev. C in print

HK 35.4 Do 17:30 1C

Excitation of the Roper Resonance in Single- and Double-Pion Production in Nucleon-Nucleon Collisions * — •Tatiana Skorodko, Mikhail Bashkanov, Heinz Clement, Evgueny Doroshkevich, Olena Khakimova, Florian Kren, and Gerhard J. Wagner for the CELSIUS-WASA-Collaboration — Physikalisches Institut der Universität Tübingen

The Roper resonance has been a puzzle ever since its discovery in πN phase shifts. Not only its nature has been a matter of permanent debate, also its resonance parameters show a big scatter in their values. In most investigations no apparent resonance signatures could be found in the observables. In these cases the Roper resonance is sensed only very indirectly via complex partial wave analyses. We find direct indications for its excitation in the invariant $n\pi^+$ mass spectrum of the $pp \to np\pi^+$ reaction at $M \approx 1360$ MeV with a width of 150 MeV. The values fit very favorably to the most recent phase shift results as well as to the observations at BES.

In the near-threshold two-pion production $pp \to pp\pi^0\pi^0$, where the Roper excitation and its subsequent decays via the routes $N^* \to \Delta\pi \to N\pi\pi$ and $N^* \to N\sigma$ are the only dominant processes, we find its direct decay into the $N\sigma$ channel to be the by far dominating decay process - in favor of a monopole nature of the Roper resonance.

Above the Roper region the $\Delta\Delta$ excitation gets the dominant reactions process for $T_p > 1$ GeV. The situation in this region will be discussed, too.

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HK 35.5 Do 17:45 1C

Two-Pion Production in Proton-Proton Collisions with Polarized Beam - Roper versus single Δ excitation * — •Arthur Erhardt, Heinz Clement, Evgueny Doroshkevich, Katharina Ehrhardt, and Gerhard J. Wagner for the COSY-TOF-Collaboration — Physikalisches Institut der Universität Tübingen

The $pp \to pp\pi^+\pi^-$ reaction was measured with a polarized proton beam at $T_p = 750$ and 800 MeV using the short version of the COSY-TOF spectrometer. The implementation of a delayed-pulse technique for Quirl and Central Calorimeter provided positive π^+ identification in addition to the standard particle identification. Differential cross sections as well as vector analyzing powers have been obtained. They are compared to previous data and theoretical calculations. In contrast to predictions we find large analyzing power values up to $A_y = 0.3$. At these measurements the dominating reaction mechanism is the excitation of the Roper resonance and its decay into the $\pi^+\pi^-$ channel either directly or via Δ excitation. From invariant $M_{\pi\pi}$ mass and $\pi\pi$ opening angle distributions we find the direct decay into the σ channel to be the dominating decay - at variance with the PDG values, but in favor of the monopole character of the Roper excitation. Since Roper excitation and decay do not result in significant analyzing powers, the reason for the measured large values may be found in small reaction amplitudes, where single Δ excitation is connected with s-wave pion rescattering - a process not sensed so far experimentally.

*supported by BMBF, COSY-FFE, DFG(Eur. Graduate School)

HK 35.6 Do 18:00 1C

Investigations on the $\Lambda(1405)$ with WASA-at-COSY — •Wojciech Weglorz for the WASA-at-COSY-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich — Nuclear Physics Department, University of Silesia, Katowice

The nature of hyperon resonance $\Lambda(1405)$ is yet not well known. It is, for example, considered to be of non-triplet quark structure or a bound $\overline{K}N$ state. Recent calculations predict the $\Lambda(1405)$ to have a two-pole structure, which has direct influence on the coupling of its $\pi\Sigma$ decay modes with the pure $\Lambda(1405)$ decaying through $\pi^0\Sigma^0$. One major difficulty in the experimental determination of the spectral shape of the $\Lambda(1405)$ (width = 50 MeV) originates in its overlap with the $\Sigma(1385)$ resonance (width = 36 MeV) while having the same charged $\pi\Sigma$ decay channels.

The WASA-at-COSY setup with a close to 4π geometrical acceptance for charged and neutral particles allows to detect all final state particles of the decay $\Lambda(1405) \to \pi^0\Sigma^0 \to (\gamma\gamma)_{\pi^0}(p\pi^-\gamma)_{\Sigma^0}$. In combination with the high density hydrogen pellet target and the COSY proton beam this provides the opportiunity to cleanly identify the $\Lambda(1405)$ in the reaction $pp \to pK^+\Lambda(1405)$ and to shed some light on its nature.

In this presentation the status of the feasibility studies are discussed.

Supported by FZ Jülich and BMBF.

HK 35.7 Do 18:15 1C

Energy dependence of the pp→K$^+$nΣ^+ reaction near threshold — •Yury Valdau for the ANKE-Collaboration — Forschungszentrum Juelich, Institut fuer Kernphysik*, Germany, D-52425 Jülich

In contrast to reactions with production of neutral light hyperons (Λ

and Σ^0) the energy dependence of the $pp \to K^+n\Sigma^+$ reaction shows a surprising behavior in close-to-threshold region ($T_p \approx 1.79$ GeV). Due to strangeness conservation below threshold of the $pp \to K^+n\Lambda\pi^+$ process there is no other source of the $K^+\pi^+$ events, thus events from genuine Σ^+ production can be identified by $K^+\pi^+$ coincidence without using a neutron detector.

The energy dependence of the Σ^+ production total cross section has been studied at four energies between threshold and ~ 2.0 GeV using the magnetic spectrometer ANKE-COSY. In the experimental data the contribution of Σ^+ production to three simultaneously measured experimental spectra (K^+ inclusive, K^+p and $K^+\pi^+$ correlation spectra) can be identified. Thus, total cross sections of the process will be determined using the ratio to other well known hyperon production channels or absolute normalization.

The status of analysis as well as preliminary experimental results will be presented.

Supported by the COSY–FFE program.

HK 35.8 Do 18:30 1C

Messung von Doppelpolarisationsobservablen in der Reaktion $\vec{\gamma}\vec{\mathrm{p}} \to \mathrm{p}\pi^0$ — •Annika Thiel für die CBELSA/TAPS-Kollaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, D-53115 Bonn

Das Anregungsspektrum des Nukleons enthält verschiedene, sich überlappende Resonanzen. Zur Untersuchung und näheren Identifikation der Resonanzen bedarf es der Partialwellenanalyse, welche zur genauen Bestimmung der Resonanzbeiträge dient. Um eine eindeutige Lösung der Partialwellenanalyse zu erhalten, werden verschiedene, wohl ausgewählte Einfach- und Doppelpolarisationsobservablen benötigt. Mit dem neuen Crystal-Barrel/TAPS-Aufbau an ELSA ist es möglich solche Doppelpolarisationsobservablen zu messen. Hierzu werden linear- oder zirkularpolarisierte Photonen und ein longitudinal polarisiertes Butanol-Target verwendet, so dass eine Bestimmung der Polarisationsobservablen E und G in verschiedenen Reaktionen möglich ist.
Mit der Datennahme des Experiments wurde letztes Jahr begonnen. In diesem Vortrag werden die ersten Ergebnisse für die Reaktion $\vec{\gamma}\vec{p} \to p\pi^0$ vorgestellt.

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HK 35.9 Do 18:45 1C

Messung der Strahlasymmetrie Σ in der Reaktion $\vec{\gamma}\mathrm{p} \to \mathrm{p}\pi^0\eta$ — •Eric Gutz für die CBELSA/TAPS-Kollaboration — Helmholtz-Institut f. Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn

Das Problem der *fehlenden Resonanzen* im Anregungsspektrum der Baryonen ist eine der offenen Fragestellungen der Hadronenphysik. Das Crystal-Barrel/TAPS-Experiment am Bonner Elektronenbeschleuniger ELSA erlaubt es hierbei eine große Zahl verschiedener Endzustände in der Meson-Photoproduktion am Nukleon zu untersuchen, die sich durch unterschiedliche Resonanzbeiträge auszeichnen.
Das Crystal-Barrel/TAPS-Experiment eignet sich insbesondere gut zur Untersuchung der Photoproduktion neutraler Mesonen am Nukleon. Dabei zeichnet sich die Detektoranordnung durch eine beinahe vollständige Abdeckung des Raumwinkels und eine hohe Detektionseffizienz für Photonen aus. Durch die Methode der kohärenten Bremsstrahlung stehen energiemarkierte, linear polarisierte Photonen für Polarisationsexperimente zur Verfügung. Polarisationsobservablen wie die Strahlasymmetrie Σ sind wichtig zur Extraktion der Resonanzparameter aus den Daten mittels einer Partialwellenanalyse.
Im Vortrag werden neue Ergebnisse zur Messung der Strahlasymmetrie Σ für die Reaktion $\vec{\gamma}\mathrm{p} \to \mathrm{p}\pi^0\eta$ bis zu einer Photonenergie von 1600 MeV vorgestellt.

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